

# **Prairie Island Nuclear Generating Plant**

## **Pre-Decisional Enforcement Conference**

August 2, 2002

**NMC**

# Agenda

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- **Introduction**
- **Factual Summary**
- **Lessons Learned**
- **Corrective Actions**
- **Conclusions**

# **Factual Summary**

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- **Calvert Cliffs event review**
- **D6 operating and maintenance history prior to April 2001**
- **April 9 D6 surveillance problems and NOED request**
- **Events subsequent to April 16 grant of NOED**
- **SIT document incident**

# 1996

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- **May - July 1996 - OE Report screened at PINGP**

- PINGP lube oils have Total Base Number(TBN) and sulfated ash properties similar to Calvert Cliffs
- No immediate action: fuel sulfur content high (0.18%), no scuffing noted during Preventive Maintenance (PM)
- Corrective actions: Discuss need to change oil with vendors, obtain recommendations for oil change by 1/1/97 to include in PM if required

- **Nov 1996 - PINGP engineer attends SACM conference**

- Summarized Calvert Cliffs experience as an “incompatibility between an entirely synthetic oil with a high TBN (>15), high CD classification, and a low sulfur fuel”
- No problems with extensive use of mineral or synthetic lube oil and low sulfur fuel in Sweden, Germany, Switzerland & France
- SACM conclusion was “not enough experience” to “express formal statements about the lubricant-fuel influences”

# 1996 - 1999

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- **Late 1996 - Mobil and SACM contacts**
- **Nov 1998 - D6 5-yr inspection and rebuild (530 hours)**
  - Some carbon buildup, rings move freely, no indications of blow-by
  - BG&E experienced engineer involved
- **Feb 1999 - PINGP attends SACM Owners Group meeting**
  - Calvert Cliffs solution included switch to mineral oil
  - PINGP engineers report on high temperature in one D6 cylinder
  - No linkage of D6 cylinder problem to oil incompatibility
- **Nov 1999 - D6 24-hr load test completed successfully**

# 2000 - 2001

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- **Jan 2000 - Revised OE due date to Nov 2000**
  - Sulfur content dropping slowly, PINGP perceived that the industry and vendors did not agree with Calvert Cliffs root cause analysis
- **May 2000 - D5 5-yr inspection and rebuild (450 hrs)**
  - No abnormal indications
- **Jul 2000 - OE closed**
  - PINGP inspections of D5 and D6 found no ring problems, no scuffing, no blow-by, and “exceptional results” after 450 and 530 operating hours
  - Calvert Cliffs reported hard deposits under rings, liner scuffing at 140-170 operating hours
  - Conclusions: (1) Lube oil change not recommended; (2) Current performance monitoring and PMs adequate to identify condition
- **Aug 2000 - Jan 2001**
  - Monthly surveillance runs and inspections satisfactory
  - No data suggesting oil incompatibility

## Summary 1996 - 2001

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- Complex technical issue, conflicting operating data
- Disagreement over Calvert Cliffs conclusion
- No evidence at PINGP after four years
- Continuing to look for indications

# February - April 2001

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- **Feb 2001 - Monthly run**
  - "Fuel oil" leak reported
- **Mar 2001 - Monthly run**
  - Elevated crankcase pressure noted in log
- **Apr 9, 2001 - Monthly run**
  - 0930 - entered TS LCO for D6 monthly run
  - 1330 - terminated engine run -- elevated crankcase pressure
  - 1500 - SACM recommends full borescope inspection
  - 1526 - D5 Operability run
- **Apr 10, 2001**
  - 1600 - Borescope identified bore polishing and blow-by on D6 E2-B1
  - 1719 - Initiated a work order to repair D6



## **D6 E2-B1 Historically a Problem**

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- Sep 1997 D6 E2-B1 high exhaust temperature
- Feb 1998 Calibrated D6 E2-B1 exhaust temperature instrument - no change
- Feb 1999 Swapped D6 E2-B1/B5 fuel injection pumps
- Apr 1999 Returned D6 E2-B1/B5 fuel injection pumps
- SACM Unable to correct
- Apr 2001 Blow-by in same cylinder

# Draft NOED Preparation

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- **Apr 11, 2001**

- Management considers contingency need for NOED to complete engine re-assembly
  - Condition Report initiated to assess cylinder problem

- **Apr 12, 2001**

- Licensing prepares initial draft NOED following guidance in NRC Inspection Manual and previous PINGP NOED request

- **Apr 13, 2001**

- 0730 - SACM Tech Rep arrives to support re-assembly
- 1300 - OC reviews draft NOED, oil incompatibility not raised as issue
- 1400 - Draft NOED request faxed to NRC
- 1430 - Conference call with NRC Staff to discuss NOED

# First Conference Call With NRC

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- **April 13, 2001**
- **PINGP participants**
  - Focus on PRA and compensatory measures
  - Mr. Carlson substitutes for system engineering
- **Site responded to NRC Staff questions**
  - History of D6 problem requiring NOED
  - Apparent cause - high crankcase pressure from blow-by in a single cylinder
    - Cause of blow-by not known
    - No indication affecting other cylinders/other engines
- **Collective engineering judgment: problem limited to E2-B1**
  - Single problematic cylinder exhibiting limited blow-by
  - No basis for tie to D5 or Calvert Cliffs
- **Result of call**
  - Additional PRA information requested
  - Follow-up call on April 16, 2001, to confirm need for NOED, PRA changes

# Weekend Repair Work

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- **Apr 14, 2001**

- 1308 - D6 reassembled
- 1835 - Start D6 break-in run

- **Apr 15, 2001**

- 0448 - Started D6 24-hr load test

- **Apr 16, 2001**

- 0449 - Completed D6 24-hr load test
- 0630 - OC meeting to approve NOED request
- 0730 - NRC conference call -- NOED verbal approval

# Second Conference Call

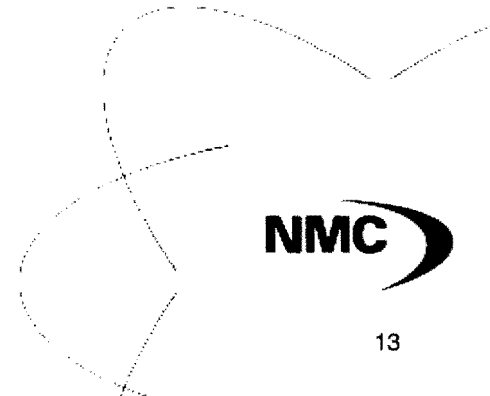
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- **April 16, 2001**
- **NOED needed - engine not re-assembled**
- **Revised PRA discussion per April 13 call**
- **NRC Staff verbally granted NOED**
- **D6 Successfully Completed 34 hours of Operation**
  - Break-in period
  - Load test
  - No unusual operating parameters, no blow-by
- **All indications were that problem limited to single cylinder**

# Context of the NOED

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- **PINGP did not suspect credible common mode failure mechanism before or during the NOED**
- **Site experience supported preliminary conclusion of an isolated cylinder problem of unknown cause**
  - Focus was on problematic E2-B1
- **Available information did not point to oil incompatibility**
  - Single cylinder
  - D5 apparently unaffected
  - Did not find any “sticky rings”
  - Questionable validity of Calvert Cliffs conclusion
  - Different type of oil (mineral v. synthetic)



# Return to Operability

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## **Apr 16, 2001**

- 0930 - NOED effective
- 1100 - Conference call with SACM (France)
  - Purpose to discuss engine condition
  - Agreement on 12-hr run and borescope to confirm “break in” marks
  - Many potential root causes discussed
  - No root cause matched all PINGP conditions
  - Oil incompatibility discussed -- SACM could not explain limitation of symptoms to a single cylinder
- 1300 - PINGP personnel and tech rep discuss status, pursue investigation

## **• Apr 17, 2001**

- 0047 - Started D6 12-hr load test
  - C/C pressure normal
  - E2-B1 temperature w/in 50 degrees of others
- 1410 - Completed D6 12-hr load test
- 1500 - Performed borescope inspection - no degradation
- 1900 - Vendor representative concurrence with D6 condition
- 2331 - Completed TS required fast start test -- D6 declared operable

# Post-NOED Period

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- **Apr 18, 2001**

- E-mail from engine vendor stating "suspect there could be incompatibility problem between fuel and lube oil"
- Root cause team forming to evaluate information

- **Apr 23, 2001**

- Requested Root Cause Report of Calvert Cliffs incident from BG&E

- **Apr 30 - May 1, 2001**

- Calvert Cliffs report received by PINGP engineer

- **May 2, 2001**

- Calvert Cliffs report issued to Root Cause team

- **May 9, 2001**

- D5 and D6 declared inoperable, Unit 2 shut down



# Calvert Cliffs Root Cause Report

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- **First reviewed April 30 - May 2**
- **Identified technical parallels between events**
  - Problem initially found in one cylinder
  - Established mineral – synthetic distinction not relevant to oil incompatibility issue
  - Discussed independent analyses and unanimous conclusion of cause
- **Provided root cause team with technical bases for oil incompatibility as the potential cause**

## **Statement of Dennis Carlson**

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- **No vendor recommended oil change**
- **No information indicated oil incompatibility in April 2001**
- **Limited role in D6 issue and NOED**
- **Provided complete and accurate responses**

# Statement of Scott Hiedeman

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- Before reading the full Calvert Cliffs report had concluded oil incompatibility problem would not develop at PINGP because:
  - Vendors did not recommend oil change and assured PINGP engines would not experience oil incompatibility
  - PINGP used mineral-based rather than synthetic lube oil
  - Absence of operating problems, especially during rebuilds
  - Potential problems could be detected in preventive maintenance
  - April 2001 incident was limited to a single cylinder

## **Statement of Scott Hiedeman (cont)**

- **The full Calvert Cliffs report changed view about the potential for an oil incompatibility problem:**

- Realized SACM agreed oil incompatibility was root cause for Calvert Cliffs (contrary to statements made by SACM's U.S. representative)
- Realized symptoms of oil incompatibility could develop in a single cylinder
- Realized significance of "Total Base Number"

# SIT Document Timeline

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- **May 14, 2001**

- Document removed from SIT production stack
- Document later retrieved by concerned employee

- **May 16, 2001**

- Concerned employee determines document appears relevant

- **May 17, 2001**

- Document returned to NRC production process
- Document produced to SIT
- ECP investigation
- ECP manager informs SIT of investigation results and confirms SIT receipt of document

# SIT Document Production

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- **Company Actions**

- Promptly investigated individual's action
- Reported incident to SIT/Senior Resident
- Ensured SIT had document

- **Determined there was no intent to withhold significant information by individual or PINGP**

## **Statement of Scott Hiedeman -- SIT**

- **Did not intend to mislead the NRC or withhold information**
- **Removed the Lube Notes article because thought it was inaccurate and misleading**
- **Removing the document was an error of judgment**

# PINGP Response

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- **Lessons Learned**
- **Corrective Actions**



# Lessons Learned

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- **Operating Experience**
- **System Engineering**
- **NOED requests**
- **NRC document requests**
- **Vendor interface**

# Lessons Learned

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- **Complacency**
- **Roles and responsibilities**
- **Lack of formal processes**
- **Management expectations, standards, accountabilities**
- **Quality validation/verification (QV&V) weaknesses**
- **Sense of ownership/urgency/follow-through**

# OE Improvements

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- **Developed very comprehensive processes for review of external OE**
- **Assigned resources**
- **Integrated OE into our daily work**
- **Formed OE oversight process/team**

# Engineering Organization Improvements

- Role/responsibility changes
- Training improvements
- Formal turnover process
- Communication standards
- Organization changes

# **NOED Request Process**

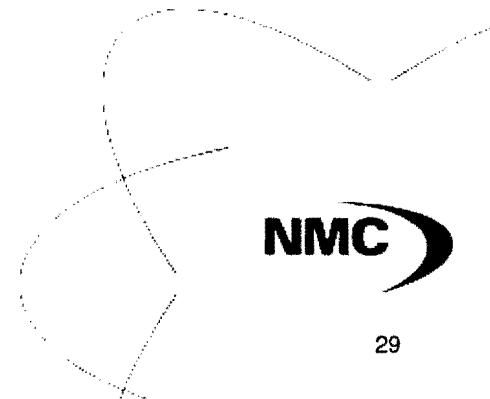
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- **Formalized Process**
- **Management Involvement**
- **Operations Committee Improvements**
- **Ownership**
- **Expectations for Site Organization**
- **Complete and Accurate Information**
- **Operation Under NOED**
- **Plant Event Investigation and Recovery Process**

# **NRC Communications**

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- **Complete and Accurate**
- **Verification and Validation Process**
- **Regulatory Compliance Organization**
- **Inspection Support Process**
- **NRC Confidence in our Communication**



# Vendor Support

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- **Expectations**
- **Communication**
- **Verification**

# PINGP Changes

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- **Learning attributes**
- **Core values**
- **Excellence plan**
- **Root cause investigation**



# Overall Summary

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- **PINGP provided NRC with as complete and accurate information as possible**
- **Lack of aggressive OE investigation inhibited root cause analysis and technical conclusions**
- **Prompt action when new information raised questions with initial technical conclusions**
- **PINGP provided all relevant documents to NRC**

# Broader Initiatives

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- **Performance Improvements**

- Management changes
- Staff realignment
- Formal processes
- Clear management expectations, standards, accountabilities
- Process assessment

- **Priority Issues**

- **Long-term Goals**

## **Conclusion**

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- **Actions were not willful violations**
- **Corrective actions are in place**
- **NRC enforcement action is not warranted**
- **Enforcement discretion is warranted**